2.2.4.5 Product Specifications

Specifications applicable to Building 447 products were final product specifications. These specifications generally concerned purity and mechanical property characteristics. There were no requirements pertaining to transuranic constituents and none were performed

2.2.4.6 Operating History

Building 447 began operations in 1956 for the purpose of supporting Building 444 manufacturing operations. The primary activities included production operations (vacuum arc melting of DU alloys, final cleaning, and non-destructive testing) and waste operations (conversion of DU materials to oxide in the chip roaster, cementation of machine turnings, and off-site shipment of waste materials). Production operations were terminated in 1989.

2.2.4.7 Current Status

Off-site shipment of waste materials continue in support of Building 444 D&D.

2.2.5 Building 865

2.2.5.1 Building Description

Building 865 is a single story facility with a high-bay area that housed the production and development equipment. The building was primarily used for supporting production and for research and development of metal working operations[13] from 1970 to 1994. The southwest corner and northern portions of the building were used for office and laboratory space.

2.2.5. Process Flow

Process flow is not applicable to Building 865. The manufacturing operations that were performed were limited to individual operations, i.e., materials entered the building for specific operations such as swaging, hydo-spinning, and extruding. They were shipped out without additional operations. Research and development operations were performed similarly.

3.0 URANIUM MASS BALANCE

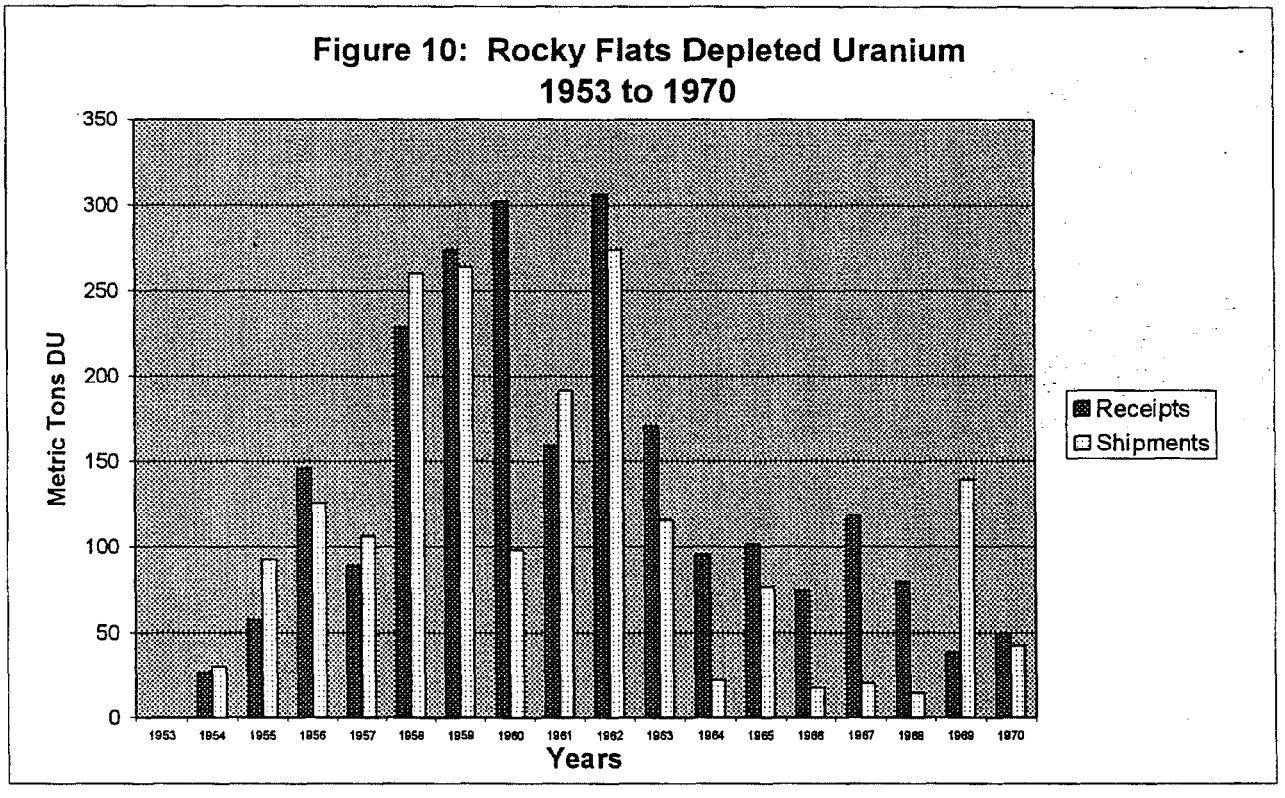
3.1 Uranium Description

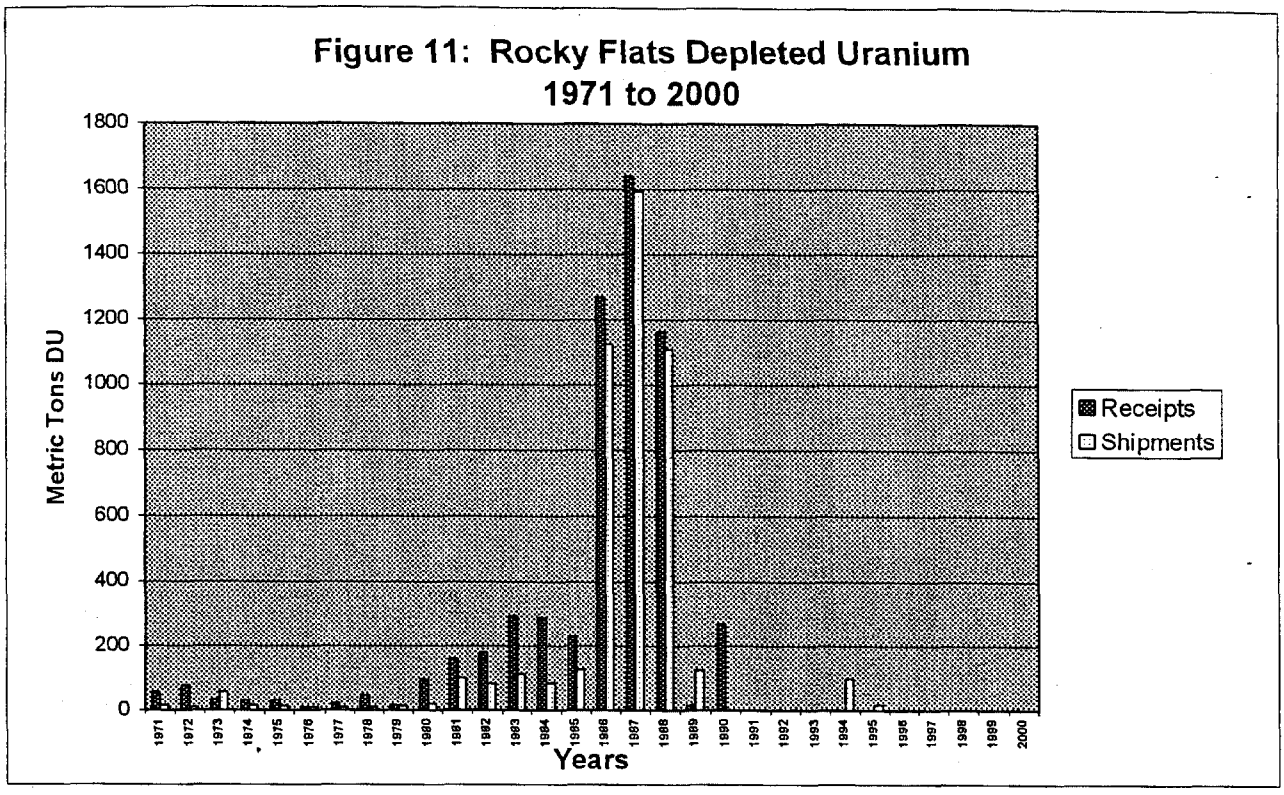
The receipt and shipping data for the Site were obtained in separate data bases for both HEU and DU. All uranium receipts and shipments were recorded in electronic data bases

without the benefit of knowing which came from recycled reactor material. The data for the 8,029 metric tons of depleted uranium is included in the attached Appendix A. Appendix B is a summary of the DU receipts and shipments for the sites.

3.2 Uranium Receipts and Shipments

The summary data on receipts and shipments of DU in metric tons for each year from 1953 through 1995 are illustrated on Figures 10 and 11. The reader should note the scale changes on Figure 11 because of the significant amounts during 1986-1988. The detail quantities of receipts and shipments for each year are listed in Appendix A. The Working Group members who collected the data made the observation that over 99% of the deleted uranium receipts were in the form of metal.





The Site received a total of 8,030 MTU of DU metal from 103 individual shipper facilities. No specific information has been received regarding which portions of this total were derived from the recycle process. Approximately 90% of the DU metal (7,173 MTU) were received from FEMP and Paducah. Comparison for the shippers mass data with the Site's receipt mass data demonstrates excellent agreement. Tables 3 and 4 summarize the shipping-receipt data from these two sites.

A significant quantity (455 MTU) of DU metal was also received from the Y-12 Plant. No mass flow information has been received from the Y-12 study for comparison. The remaining DU metal material of 392 MTU was received from 100 different supplier facilities. Many of these facilities have closed or have undergone organizational and/or operational transitions. No attempt has been made to reconcile the Site's mass balance receipt data with these facilities.

Some of the data shows variation between shipper and receipt data for some years. This is probably due to some data on a fiscal year and some on calendar year, the change in the fiscal year during this period, and changes in contractors during a year.

TABLE 3

Fernald DU Ship Data vs.
RFETS DU Receipt Data - 1972 through 1989
(All data in MTU)

Year	Fernald Ship Data	RFETS Receipt Data	△ (Fnld- RF)
1972	0.1	0.1	0
1973	--	--	--
1974	1.8	1.8	0
1975	20.5	20.5	0
1976	7.5	7.6	-0.1
1976A	2.0	2.0	0
1977	19.6	19.6	0
1978	45.5	45.5	0
1979	16.4	16.4	0
1980	93.1	93.1	0
1981	125.5	125.5	0
1982	141.1	141.1	0
1983	290.1	290.1	0
1984	283.8	283.8	0
1985	221.0	221.0	0
1986 (FVA)	1,099.7	1,099.7	0
1986 (FVC)	173.4	173.4	0
1987	1,641.2	1,641.2	0
1988	1,163.8	1,163.8	0
1989	6.6	6.6	0
Totals	5,352.7 + 1,483.8 6,836.5	5,352.8	0.1

It should be noted that the Site has data on receiving 337 MTU of DU material from Fernald from 1953 through 1957. The Fernald data did not include these years.

TABLE 4

PGDP DU Ship Data vs.
RFETS DU Receipt Data - 1955 through 1975
(All data MTU)

Year	PGDP Ship Data	RFETS Receipt Data	△ (PGDP- RF)
1955	2.3	2.3	0
1956	--	--	--
1957	107.6	86.9	20.7
1958	226.3	246.9	-20.6
1959	273.4	273.3	0.1
1960	143.7	143.7	0
1961	188.2	188.1	0.1
1962	84.7	60.9	23.8
1963	--	23.9	-23.9
1964	--	--	--
1965	9.6	9.6	0
1966	106.3	106.3	0
1967	69.9	69.9	0
1968	27.1	25.5	1.6
1969	44.1	43.3	0.8
1970	4.8	7.3	-2.5
1971	52.7	52.8	-0.1
1972	71.6	71.6	0
1973	32.0	31.9	0.1
1974	26.7	26.7	0
1975	12.8	12.8	0
Totals	1,483.8	1,483.7	0.1

A total of 6,379 MTU of DU accountable material was shipped from the Site based on the records. The difference between the receipts and shipments is believed to have been discarded as waste except for the current inventory of approximately 265 MTU pending disposition. The facility receiving the majority of this material (2,412 MTU) was a site designated with a

Recording Identification Symbol (RIS) of BBB. To date the Site has not been able to trace the BBB RIS code to a specific site. The time frame is in the period when the Site was supporting the DOD tank armor program. It is believed that the sensitivity of the program at that time man be responsible for the inability to establish positive confirmation that this material was shipped as part of Special Manufacturing Capability in Idaho. A comparison of the Site's shipping data with Fernald's receiving data is shown in Table 5.

TABLE 5

RFETS DU Ship Data vs.
Fernald DU Receipt Data - 1970 through 1988
(All Data In MTU)

Year	RFETS Ship Data	Fernald Receipt Data	△ (RF-Fnld)
1970	0.4	--	0.4
1971	--	0.4	-0.4
1972	0.7	0.7	0
1973	0.4	0.4	0
1974	--	--	--
1975	0	0	0
1976	0.2	0.2	0
1976A	--	--	--
1977	1.2	1.2	0
1978	0.5	--	0.5
1979	--	0.5	-0.5
1985	0	0	0
1986 (RIS FVA)	35.6	35.5	0.1
1986 (RIS FVC)	402.6	401.6	1.0
1987	567.3	567.7	-0.4
1988	310.3	309.9	0.4
Totals	1,319.2	1,318.1	1.1

3.3 Inventory as of March 2000.

The Site terminated accountability activities relating to DU material in 1996 and declared the remaining material as waste. Therefore, based on the definition of inventory for this report the Sites' inventory is zero. At that time, the Site's DU waste inventory was

approximately 335 metric tons (MTU). That total was composed of 155 MTU of metal materials and 180 MTU of roaster oxide. In FY1999, approximately 70 MTU of metal material was shipped to a DOE low-level waste repository at Nevada Test Site. Information from the source sites has shown that all the DU received by the site was *de minimis* which results in all the waste also having *de mininis* levels. Table 6 provides the current waste inventory.

Table 6

Current Waste Inventory (estimated)

Metal[1]	
Building 444	73 MTU
Building 664	12 MTU
Subtotal	85 MTU
Roaster Oxides[2]	
Storage Locations: Buildings 444, 447, 664, 750, 865, 883, 884 and Pads 904 and 906	180 MTU
Total (metal and roaster oxides)	265 MTU

(1) Includes both alloyed and unalloyed metal material

(2) Roaster oxides are categorized in two item description codes (IDC) grouping. IDC 069 (low-level mixed) contains approximately 120 MTU; and IDC 869 (low-level) contains approximately 60 MTU.

4.0 RESULTS AND CONCLUSIONS

4.1 Explanation of Flow Paths

The Uranium processing at the Site was primarily the production of both War Reserve and Special Order products. The source materials were received from a number of sites and processed into deliverable metal products. The detail flow paths for the concerned buildings are covered in Section 2.0 of this report.

4.2 Processes and Facilities with Potential Exposure to Uranium Constituents

The melting and casting operations in Buildings 881 and 444 had the potential to concentrate lower weight oxides in the dross or skull. The chip roasting operation in

Building 447 had the potential to release some oxides into the ventilation system. The machining of uranium products was performed in the open building atmospheres with coolant to prevent fires. However, over the years there were instances of machining chip fires which had the potential to release oxides into the working areas. These had the potential for worker exposure in the workplace. A summary of the activities where workers were most likely to be exposed to the contaminates in recycled uranium is shown on Table 7.

Table 7.

Activities at Rocky Flats Where Workers Were Most Likely To Contact Recycled Uranium

Location	Activity	Time Frame	Potential Constituents of Interest
Bldg. 444	Vacuum melting and casting of DU materials were performed in Building 444; this operation was considered as having potential for releasing or concentrating TRU or Tc constituents. While no analyses were performed by Rocky Flats, information reported in the Fernald final RU report (Section 2, pg. 18) and INEEL final report (pg. 2) appear to offer conflicting opinions regarding whether casting operations resulted in concentration of constituents.	1953 thru 1989	No information available.
Bldg. 444	Spontaneous ignition of machine turnings often occurred during DU machining operations and had potential for exposing personnel to release of TRU and Tc constituents.	1953 thru 1993	No information available.
Bldg. 447	Machine turnings were converted to oxide via a chip roasting process for disposal as low level waste. This operation was considered as having potential for releasing TRU and Tc constituents and possible exposures to personnel.	1953 thru 1989	No information available.
Site Industrial Area	During the early years of production, uranium materials (e.g., used machine oils and organics, etc.) were burned in open pits in the Rocky Flats industrial area. This activity had potential for release of TRU and Tc constituents to the environment.	1953 thru ~1965	No information available.

4.3 Potential Environmental Release

The building exhaust ventilation systems always contained high efficiency filters prior to exhausting to the environment. Direct release to the environment was measured down steam from these filters. Appendix B contains the Airborne Emission Estimates for HEU and Du from the Site from 1953 through 1989. These data were extracted from the report, *Estimating Historical Emissions from Rocky Flats 1952-1989*[15] prepared for the

CDPH&E. Note that all the data are in micro-curies. There is no evidence of any significant release from this source.

The Site did bury uranium in drums in the early years. In recent years the drums in the T-1 trench have been dug up, removed from the Site, and the area surrounding the location remediated. There may be other buried uranium in the early dump sites at the Site. These dump sites have been identified and will be addressed in the Rocky Flats Closure Project. Currently, there is a separate action to sample the ground water at a number of locations for U-236. The results of this sampling will be of interest to this evaluation as U-236, if found, could only be from recycle uranium. Depleted uranium lathe coolant and other DU contaminated organic liquids were burned in open pits in the 60's and 70's. Estimates of the release during burning were based on environmental data taken during the burn operations and are contained in the CDPH&E report.

4.4 Data Sources and Confidence Level

There is a confidence on the mass balance data for both the highly enriched and depleted uranium because of the extensive data search through all the Site receipt and shipping records. Mass balance data on shipments and receipts of depleted uranium between the Site and Fernald and Paducah, the largest suppliers, have been compared. The summaries of the data comparison are listed in Tables 3 and 4. The depleted uranium data are in close agreement considering the time span and amount of material shipped. No comparison of the highly enriched uranium mass balance data has been conducted, but it is expected these data are very accurate because of the tracking system used between the sites that required immediate resolution of any shipper receiver differences.

The evaluation of processes to determine any that could result in accumulation or release was based on the collective memories of a number of "old- time" employees. While not as specific as the mass balance activity, there is confidence that these employees had an understanding of the task to evaluate prior processing history.

5.0 HEALTH PHYSICS PROTECTION FEATURES FOR URANIUM WORK AT ROCKY FLATS[14]

During the hot startup of the uranium facilities, and during the entire period of operations in the various uranium buildings at Rocky Flats, the following practices, measures, and protective procedures for uranium workers were followed by DOE and the operating contractors:

- Physicals were accomplished for all personnel prior to date of hire by the Site's medical staff, and periodically thereafter.

- Company clothing was furnished and laundered by the operating contractor. The protective clothing included: coveralls, smocks, underwear, socks, caps, gloves of various types, and shoe covers, as required. The clothing was monitored for radioactivity and laundered on a daily basis.